

REMARKS

In response to the advisory action, applicants submit herewith the enclosed amendment with the Request for Continued Examination filed Concurrently herewith. The claims amendments are the same as those that were not entered in applicants' prior response.

Claims 1, 4, and 8-22, as amended, appear in this application for the Examiner's review and consideration. Claims 1, 9 and 19 have been amended to include the recitation that previously appeared in claims 3, which is now cancelled, namely that the detachment force is applied to both the super-weakened region and the main region. Claims 20-22 have been amended to clarify that the detachment force is applied to an angular section of the weakened zone. In view of the following, it is believed that all claims are now in condition for allowance.

Claims 20-22 have been amended to provide clear antecedent basis as well as to further define the invention in a more clear manner. It is submitted that these changes overcome the rejection.

Claims 1, 3, 4, 8-12 and 14-22 were rejected over the combination of US patents 6,597,039 to Ohmi et al. ("Ohmi") and 6,162,705 to Henley et al. ("Henley") for the reasons set forth on pages 3 to 7 of the office action, while claim 13 was rejected over the combination of Ohmi, Henley and US patent application 2003/0234075 to Aspar et al. ("Aspar") for the reasons set forth on page 7 of the office action.

Ohmi discloses composite substrates and various methods of manufacture. In one method, the composite member is separated into a plurality of members at a separation area, in which a mechanical strength of the separation area is non-uniform along a bonded face. To do this, especially, in the separation area, a peripheral portion of the composite member is preferably lower in mechanical strength than a central portion. Additionally, the separation area is preferably lower in mechanical strength than the bonded interface. According to another method a composite member formed by bonding a first base substrate and a second base substrate to each other is separated into a plurality of members at a separation area formed in a position different from a bonded face, a mechanical strength of the separation area being non-uniform along the bonded face, and a mechanical strength of a peripheral portion of the separation area being locally low.

As noted in the office action, Ohmi does not disclose applying a controlled detachment force obtained by heating at least the weakened zone wherein the heat is applied

substantially evenly over substantially the entire weakened zone. The Examiner cites to Fig. 6A of Ohmi as support for applying the thermal treatment to the composite member. Ohmi's specification for that figure simply states that "As shown in FIG. 6A, an inner stress generated by thermal treatment or the like or an external force is used to separate the composite member." This certainly is not what is presently claimed, namely, applying heat substantially evenly over substantially the entire weakened zone (all claims), such as by the use of heating elements that are independently controlled for evening the application of heat to the weakened zone (claim 9). As Ohmi does not teach these features, this may be why he discusses that heating of the entire substrate is an un-desired method. Thus, the Henley patent is cited in an attempt to remedy the deficiencies of Ohmi.

Henley discloses a method of controlled cleaving process in the fabrication of SOI according to the well known SMART-CUT® layer transfer technology. The controlled cleaving in Henley is obtained by providing pulses of energy, typically at or near the edge of the wafer (see Figures 5 and 6). Henley's discussion of heating is not a disclosure of the present claims since he is not applying heat substantially evenly over substantially the entire weakened zone such as by the use of heating elements that are independently controlled for evening the application of heat to the weakened zone. Instead, Henley uses pulses or a blade to initiate propagation of the cleaving front throughout the wafer. Also, Henley states that the thermal source may be applied in any manner, including as "time varying, spatially varying or continuous" (see column 7, lines 40-41) which further indicates that it is not uniform.

Henley also does not disclose the features of the present claims. In particular, Henley does not use uniform heating as claimed and for that reason adds nothing to the disclosure of Ohmi to result in the present invention. Henley discloses applying a pulse that is clearly localized to the edge of the wafer. If combined with the super weakened area of the present invention, there would be uncertainty regarding the initiation of the splitting either at the super weakened area or at the location where the pulse is applied. As noted above, the claims have been amended to recite that the detachment force is applied to both the super-weakened region and the main region such that the detachment initiates and propagates from the super-weakened region through the main region to detach the layer from the remainder portion.

The importance of this recitation, as shown in the application, is that the combination of a localized super weakened zone and homogenous heating enable the method to

limit and control the occurrence of "hot points" or "hot regions" on the wafer that would otherwise directly result in increased roughness over the as split surface after the layer is detached (see paragraphs 42 and 43 of the published application). In addition, Henley clearly applies detachment energy to a selected region (see col. 13, ll. 13-25), e.g.:

"controlled-cleaving by way of SELECTIVE energy PLACEMENT or POSITIONING or TARGETING 2301, 2303"...

"providing energy 2301, 2303 to a SELECTED REGION of the substrate to initiate a controlled cleaving action "

Thus, Henley is applying a force to one specific region in an attempt to provide controlled cleaving from that region throughout the wafer. This is not what is currently claimed and it certainly does not teach the application of a detachment force to both the super-weakened region and the main region. Instead, the combination of Ohmi and Henley would lead to the application of energy to a SELECTED region of Ohmi's wafer. Furthermore, Ohmi teaches against the use of heating as it is not preferred in his disclosure. This would not be considered as appropriate by a skilled artisan since this application of energy would actually amplify the problems encountered in Ohmi's method, i.e. this would lead to strong "hot points" corresponding to the selected region and increase roughness in an enlarged zone.

In contrast, in the present invention, heat is homogenously and uniformly applied to avoid such hot spots. This certainly provides unexpected advantages for the present process that support the patentability of the present claims. In view of this, the rejection based on the combination of Ohmi and Henley has been overcome and should be withdrawn.

Regarding the rejection of claim 13 over the combination of Ohmi, Henley and Aspar, Aspar does not remedy the deficiencies of the Ohmi and Henley patents. As previously explained, Aspar discloses a method for transferring a thin layer from a block of material, by separating the superficial part of the block (or thin layer) from the remaining part by the application of a thermal treatment and/or the application of mechanical forces acting between the superficial part and the embrittled zone, but he does not disclose applying a controlled detachment force to both the super-weakened region and the main region. Thus, Aspar does not remedy the deficiencies of the other references to render the present claims obvious, and this rejection should also be withdrawn.

A Supplemental Information Disclosure Statement is enclosed, but it is respectfully submitted that the references cited thereon are not material to the patentability of the present claims. The Examiner's agreement to this is respectfully requested by the completion and return of the enclosed PTO form 1449.

Accordingly, as all rejections have been overcome, it is believed that the entire application is now in condition for allowance, early notice of which would be appreciated. In the event that the Examiner does not agree that all claims are now allowable, a personal or telephonic interview is respectfully requested to discuss any remaining issues in an effort to expedite the eventual allowance of this application.

Respectfully submitted,

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Date



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